Comparison of Landsat and RapidEye Data for Change Monitoring Applications

presented by Jon Dykstra, PhD.

www.mdaus.com

Outline

- Introduction to MDA's Change Detection (CLC) Technologies

- Landsat as Source to CLC

- RapidEye as Source to CLC

- LS/RE: Strengths and Weaknesses

Monitoring Change

- Change in what?
  - Man-made features; human activity
  - Change that persists
  - Triply confirmed change

- Time scale / frequency of change
  - "Persistence" is feature dependent
    - Urban development: quarterly – annually
    - Crop development: weekly – monthly
    - Port monitoring: hourly – daily

Efficient Geospatial Solutions
2012

Use, duplication or disclosure of this document or any of the information contained herein
is subject to the restrictions on the title page of this document.

3

Detecting Persistent Change

- Change Detection – 3 Categories
  - Visual – human eyeballs
    - Expensive and time consuming
    - Tight coregistration is not a requirement
  - Object Oriented – machine understanding
    - Difficult/expensive to implement
    - Tight coregistration is a nice to have
  - Spectrally Based – leveraging MSI
    - Operational and cost effective
    - Tight coregistration is CRITICAL to success

Correlated Land Change - CLC
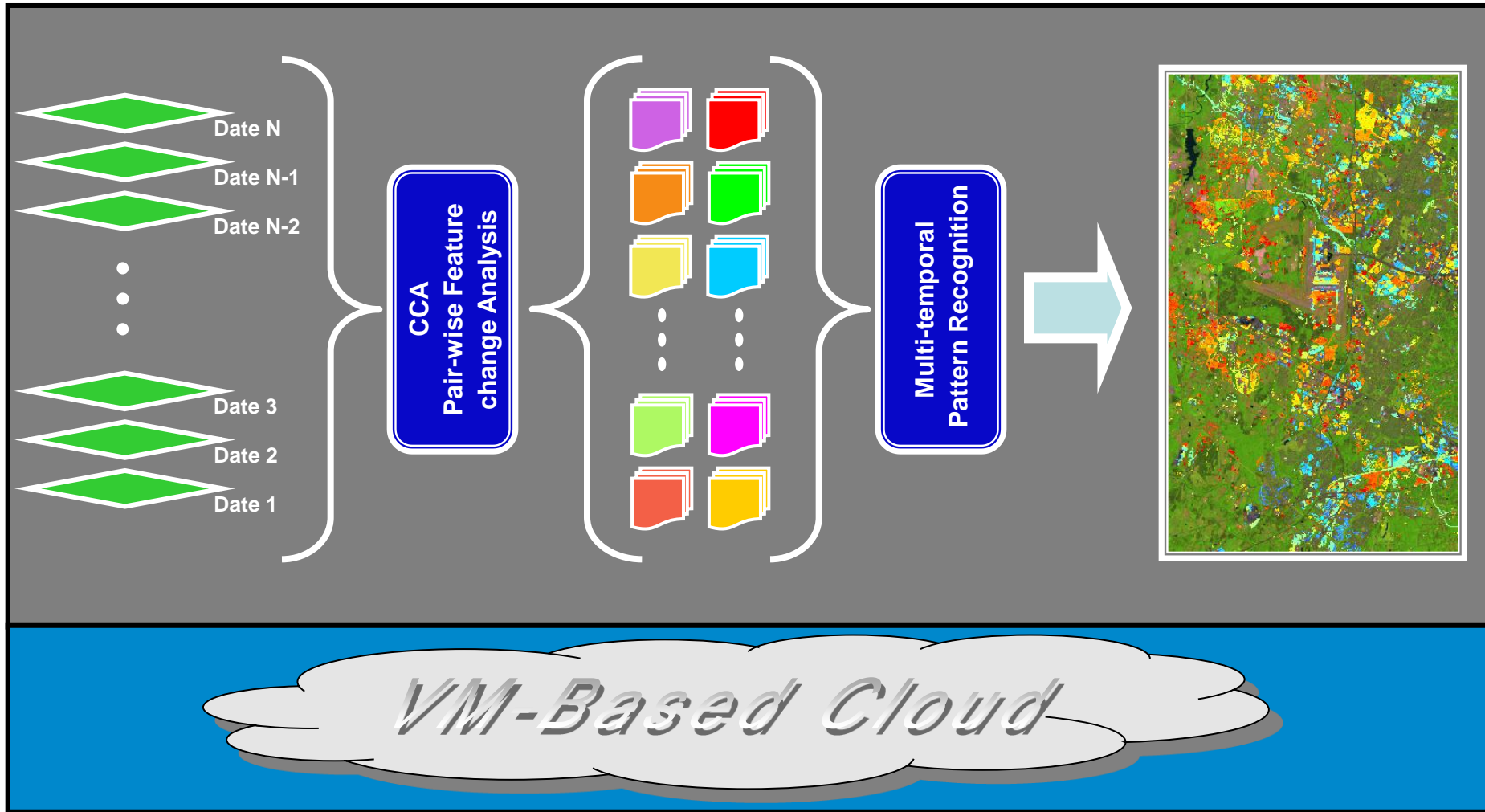
Outline

- Introduction to MDA's Change Detection (CLC) Technologies

- **Landsat as Source to CLC**

- RapidEye as Source to CLC

- LS/RE: Strengths and Weaknesses

25 Years of Landsat Coverage

Acquisition Dates

2009-Oct19
2009-Jul15
2008-Jun10
2007-May07
2006-Aug24
2005-Nov25
2004-Apr28
2003-Sep17
2002-Jun10
2001-Oct05
2000-Jul06
1999-May01
1998-May14
1997-Oct02
1996-Oct15
1995-Sep27
1994-Aug23
1993-Oct23
1991-Oct18
1990-Aug12
1989-Mar18
1988-Jul05
1987-Jun25
1986-Oct20
1985-Aug14
1984-Aug27

I-270 Corridor, MD

Gaithersburg, MD

Gaithersburg, MD
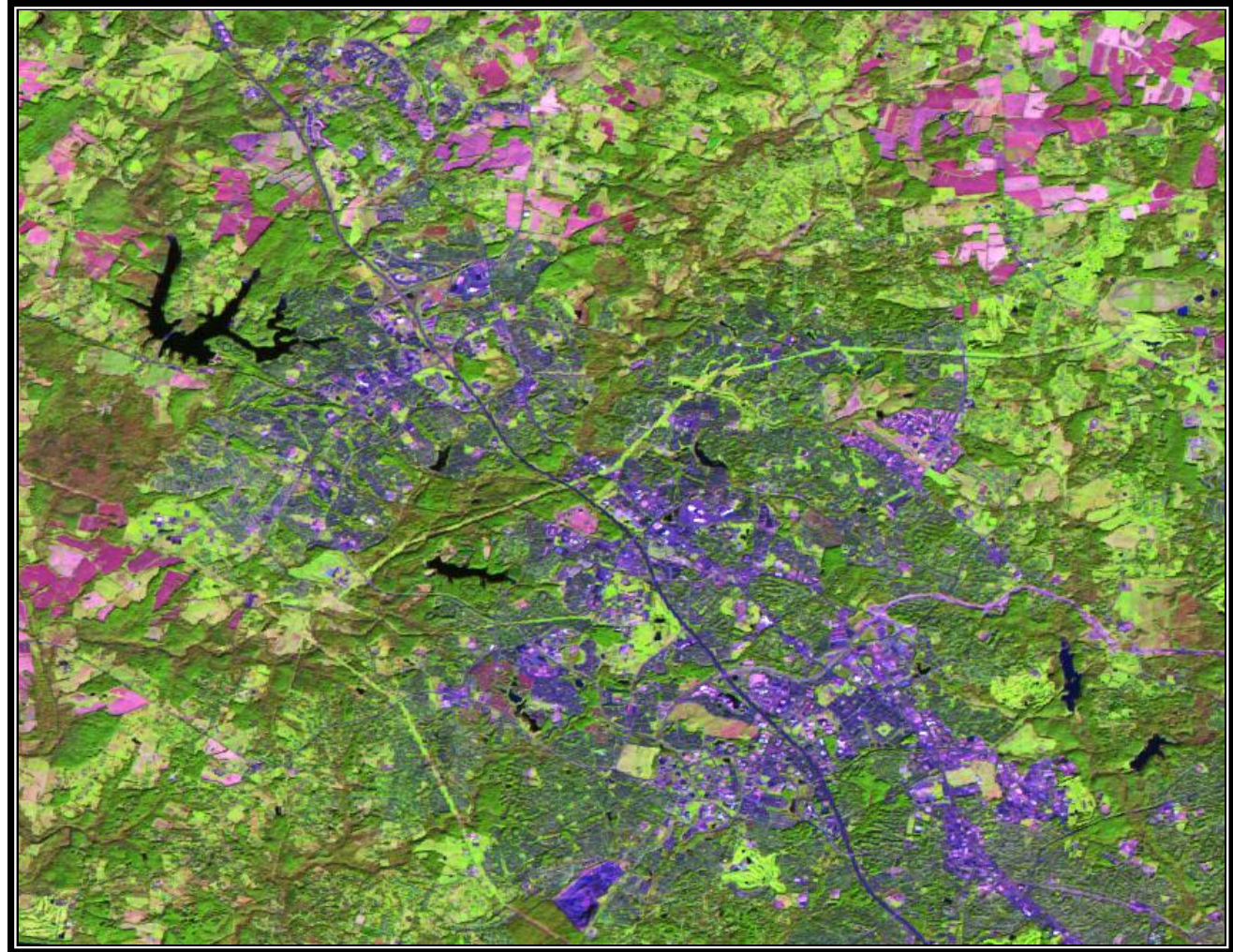
Change

2008-09_EI
2007-Change
2006-Change
2005-Change
2004-Change
2003-Change
2002-Change
2001-Change
2000-Change
1999-Change
1998-Change
1997-Change
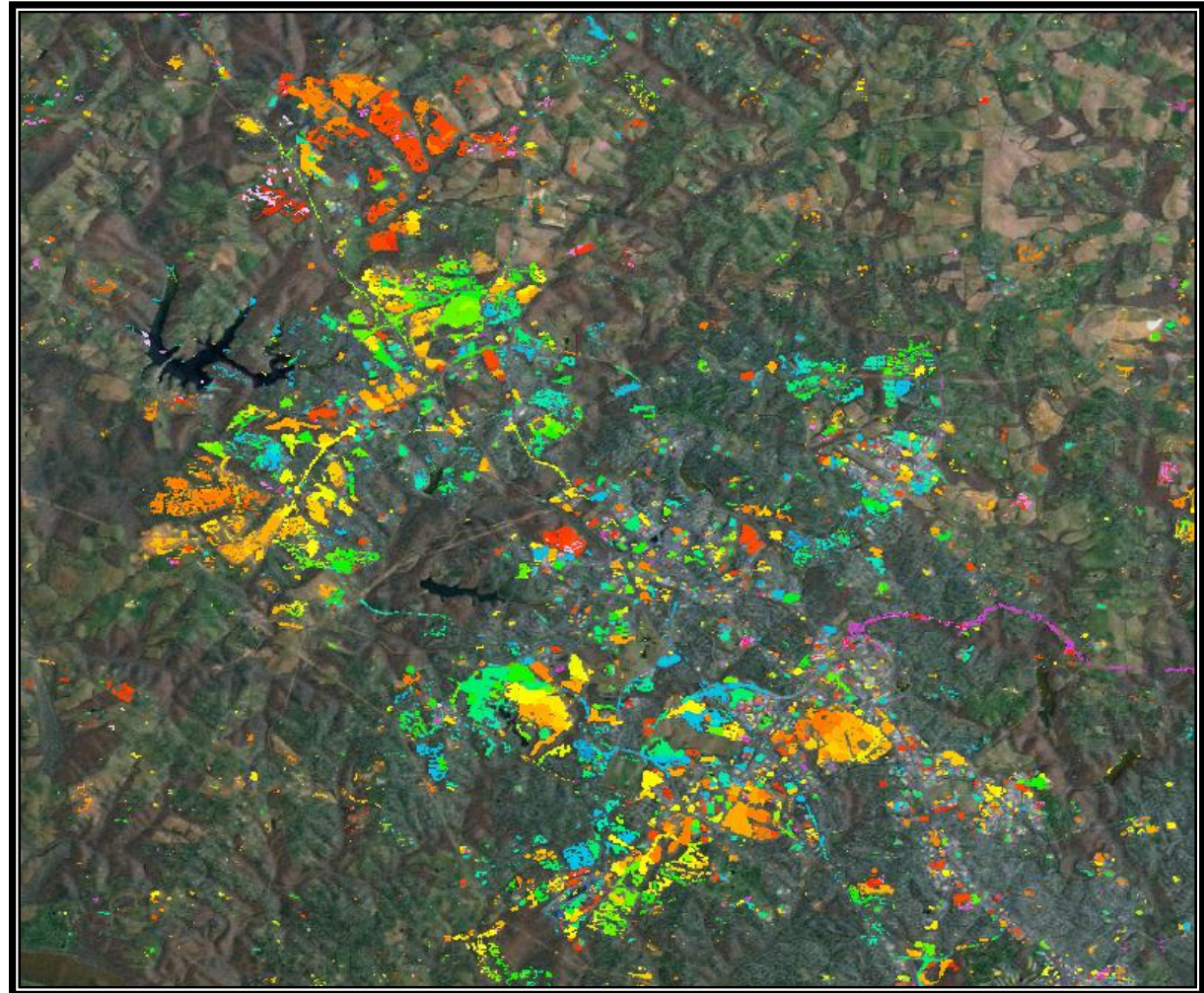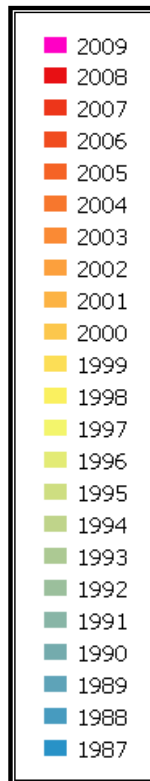1996-Change
1995-Change
1994-Change
1993-Change
1991-Change
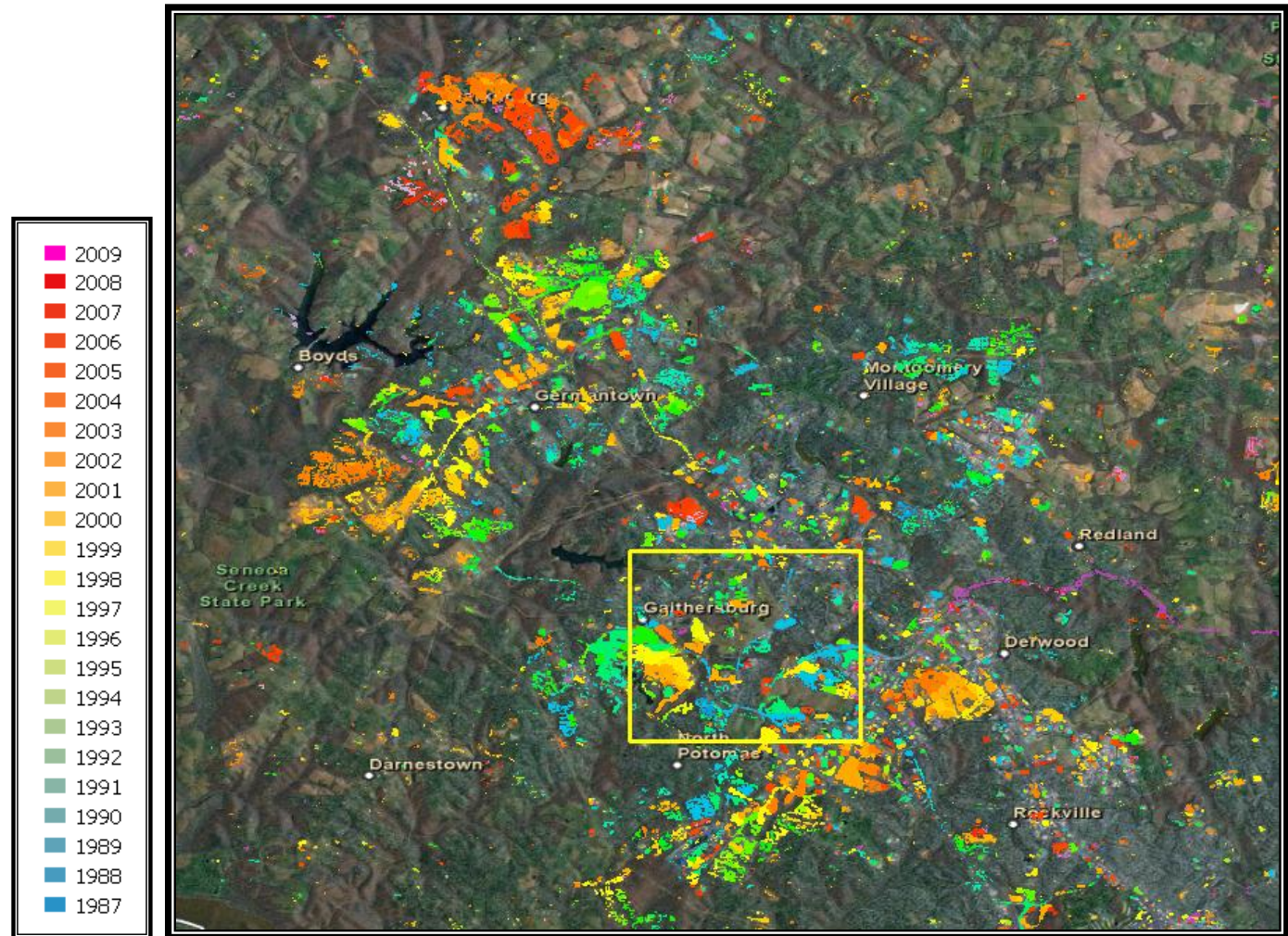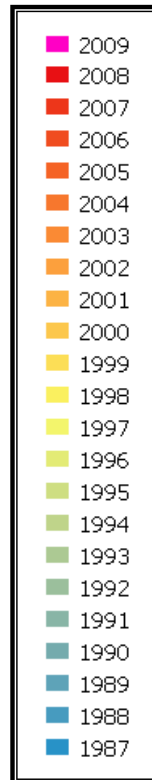1990-Change
1988-89-Change
Aerial Photo 2008

Landsat as CLC Source

- Landsat: Excellent source for CLC
  - Wide spectral range
    - Six bands over 30 meter pixel
  - Tight date-to-date coregistration
    - Nadir collection
  - Consistent area coverage
    - WRS controlled
  - Deep archive (outside of EOSAT Shadow)
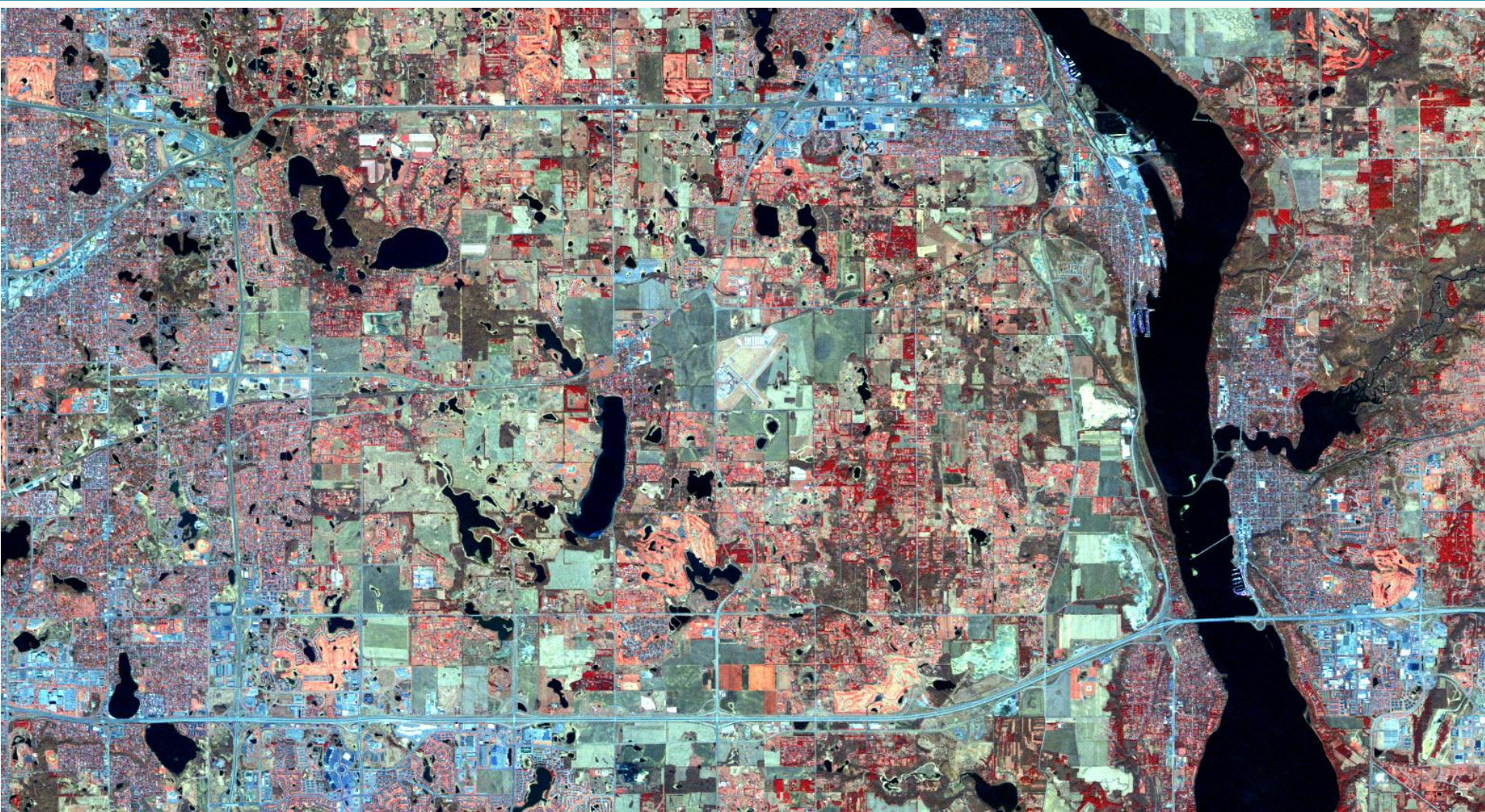   - Global: 1982-85 and 1999-present

Outline

- Introduction to MDA's Change Detection (CLC) Technologies

- Landsat as Source to CLC

- **RapidEye as Source to CLC**

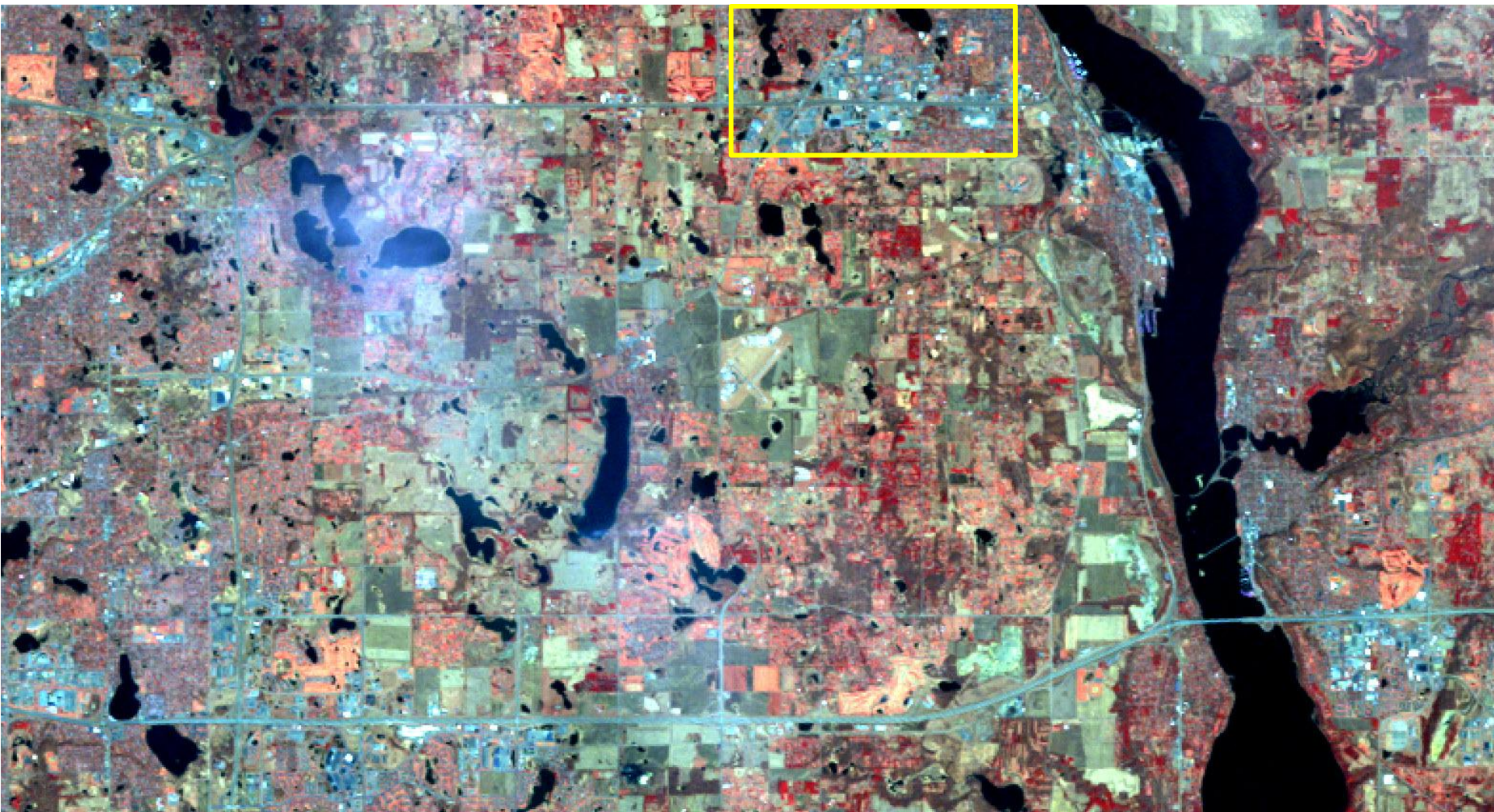- LS/RE: Strengths and Weaknesses

RapidEye (07Apr09) – False Color
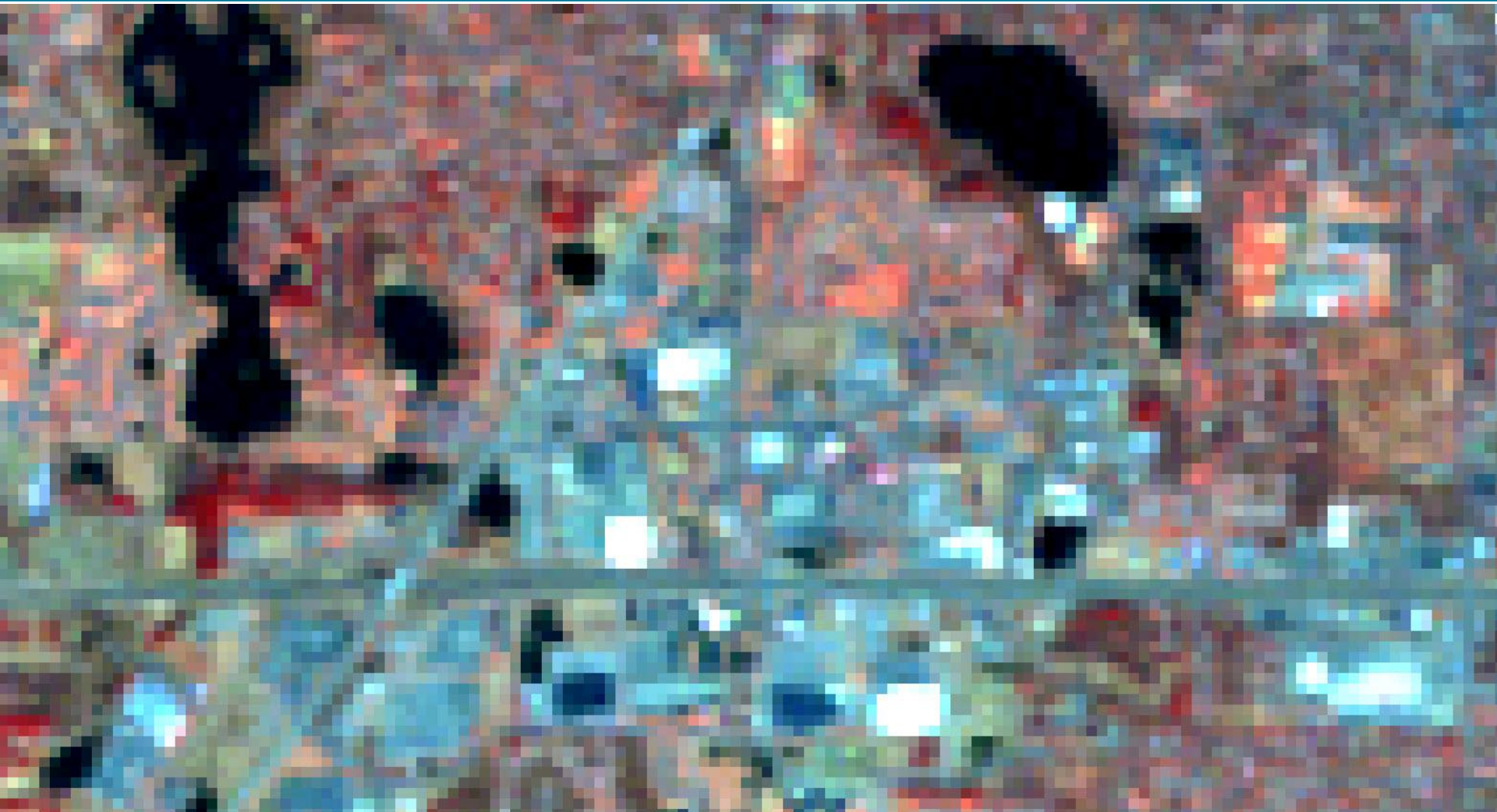
Landsat (07Apr09) – False Color

Landsat (07Apr09) – False Color

RapidEye (07Apr09) – False Color

RapidEye / Landsat (both 07Apr09)

RapidEye: 8 scenes / 11 Months

RapidEye Data

- 24-Feb-10
- 20-Feb-10
- 07-Oct-09
- 12-May-09
- 10-May-09
- 08-Apr-09
- 31-Mar-09
- 15-Mar-09
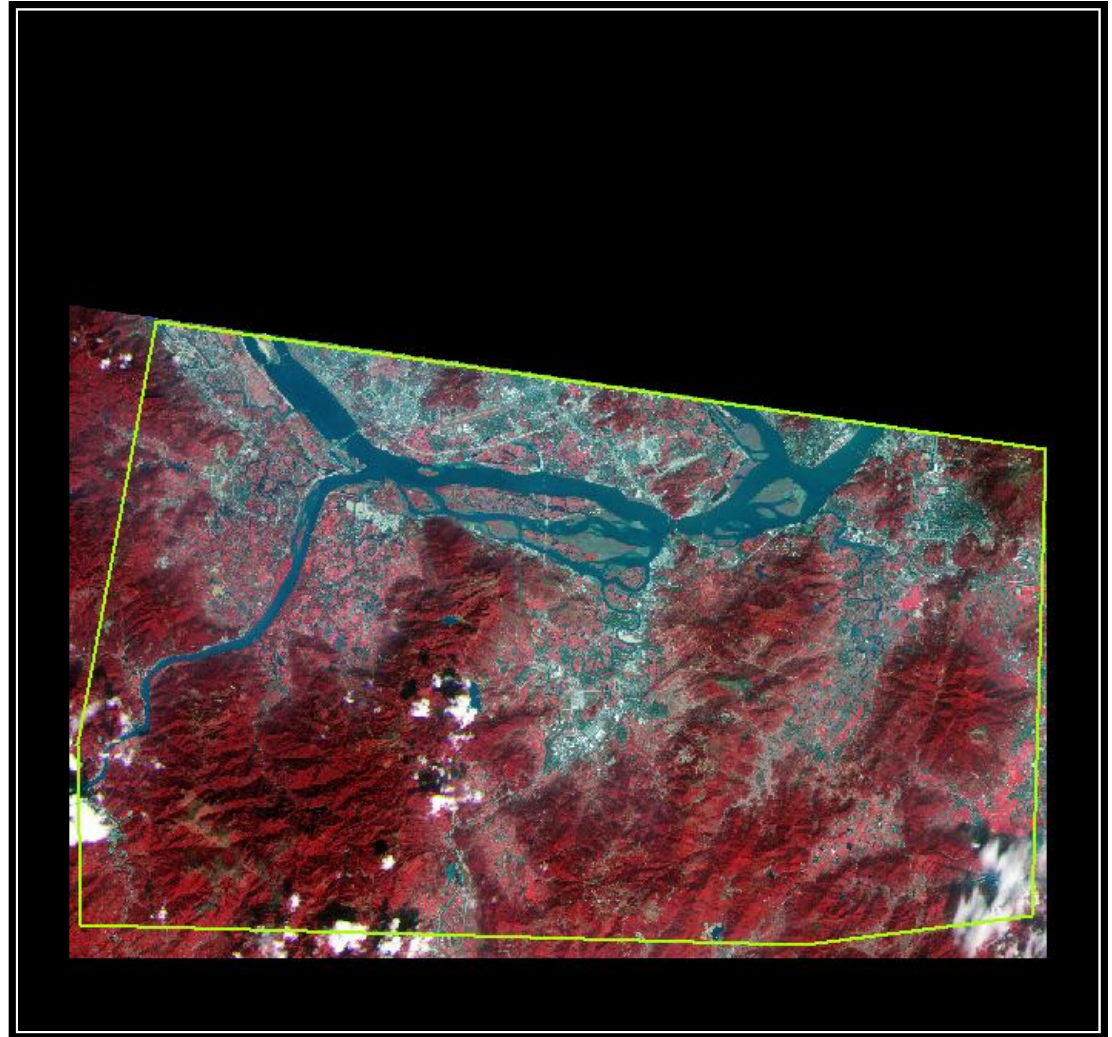
RapidEye CLC Change
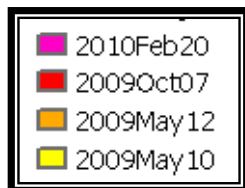
RapidEye Data

CLC Change

■	2010Feb20
■	2009Oct07
■	2009May12
■	2009May10

RapidEye CLC Change

RapidEye Data

CLC Change

■	2010Feb20
■	2009Oct07
■	2009May12
■	2009May10
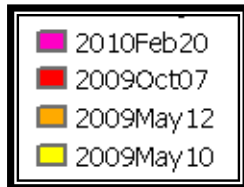
RapidEye Off-nadir Challenge

RapidEye Data

- 24-Feb-10
- 20-Feb-10
- 07-Oct-09
- 12-May-09
- **10-May-09 (nadir)**
- 08-Apr-09
- 31-Mar-09
- **15-Mar-09 (13 deg.)**

RapidEye Off-nadir Challenge

RapidEye Data
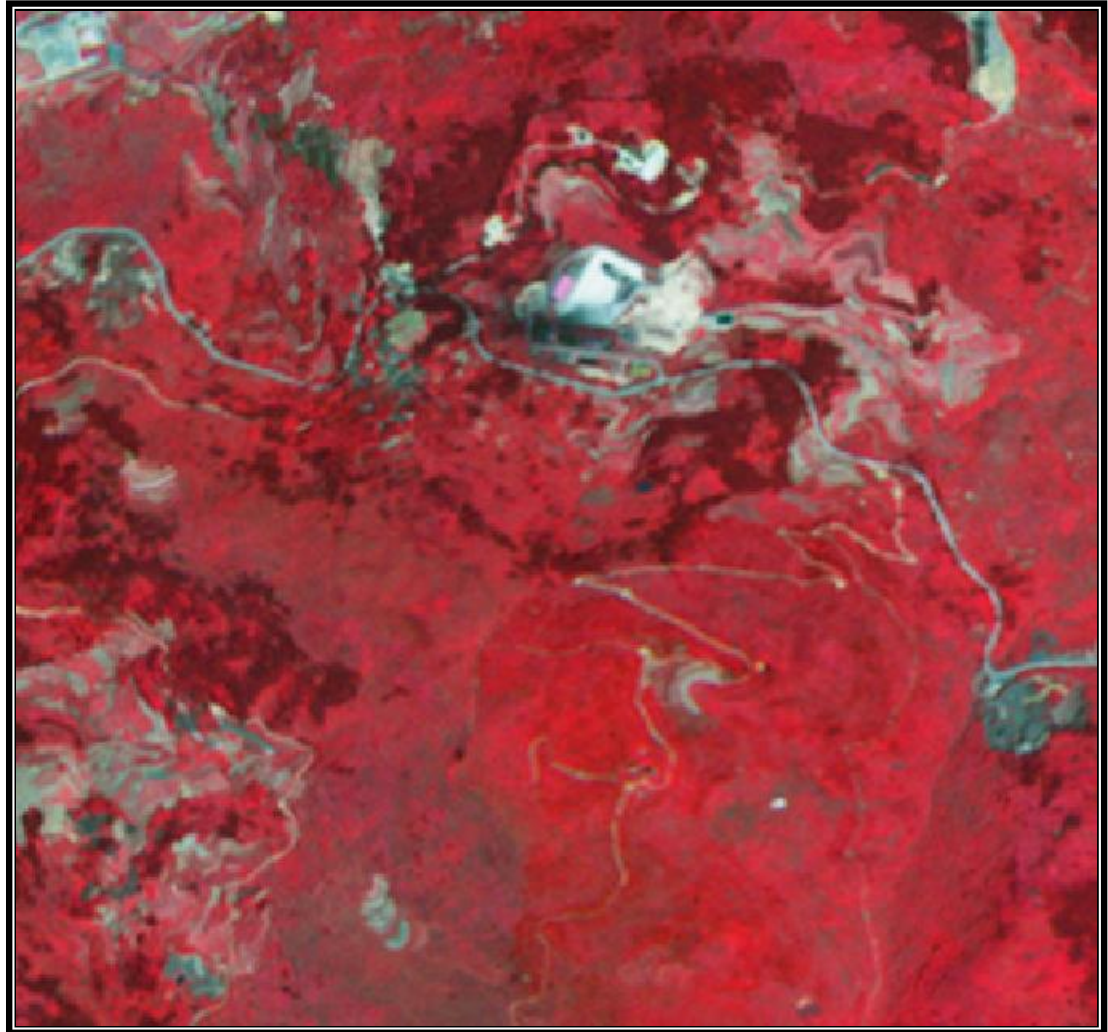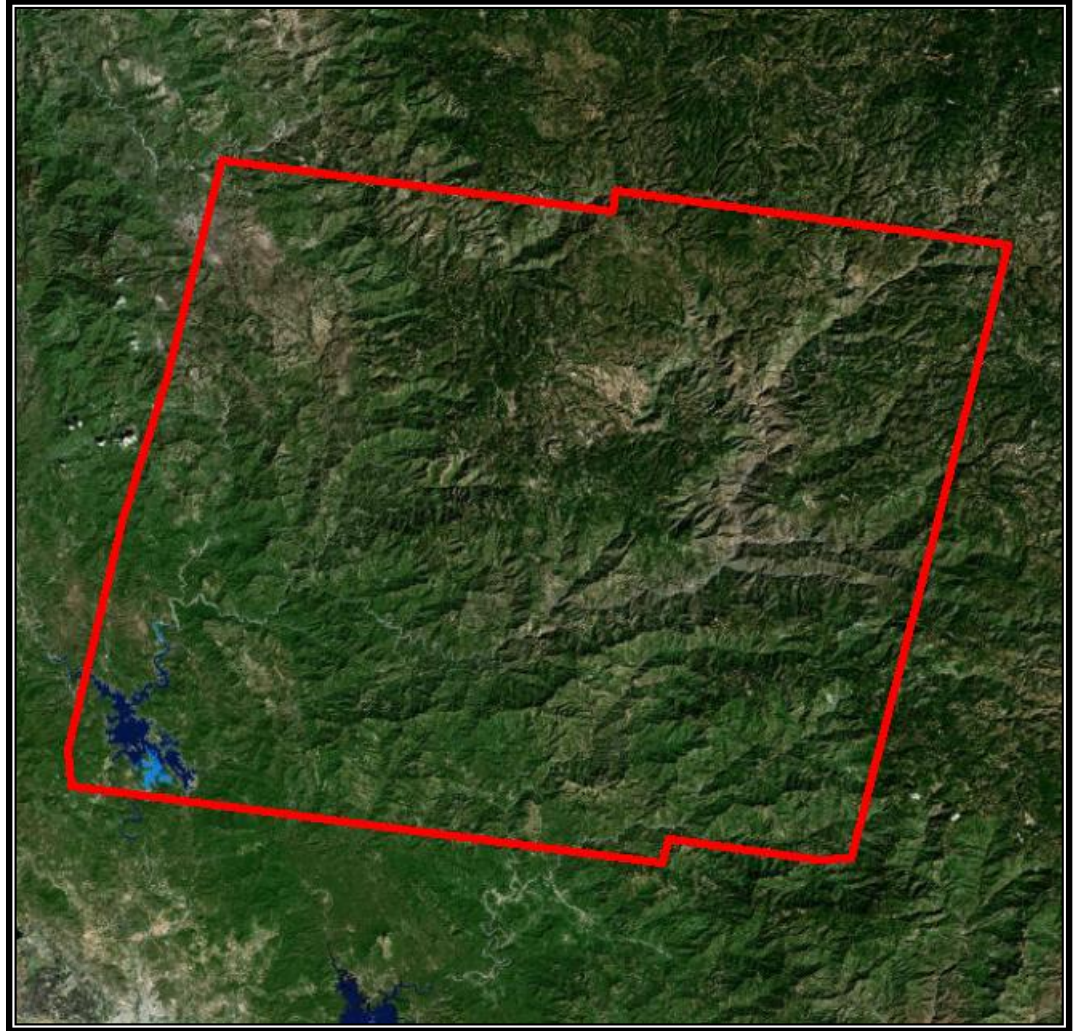
- 24-Feb-10
- 20-Feb-10
- 07-Oct-09
- 12-May-09
- **10-May-09 (nadir)**
- 08-Apr-09
- 31-Mar-09
- **15-Mar-09 (13 deg.)**

AOI ~100x100 kilometers

RapidEye Temporal Coverage

Change

2011-09-24 ⎤
2011-09-22 ⎦ **2 Days**
2011-09-07
2011-08-20
2011-07-25
2011-06-29 ⎤
2011-06-26 ⎦ **3 Days**
2011-05-02 ⎤
2011-05-01 ⎦ **1 Day**
2011-04-17 ⎤
2011-04-16 ⎦ **1 Day**
2011-02-16 ⎤
2011-02-13 ⎦ **3 Days**
2011-01-23
2011-01-18 ⎤
2011-01-17 ⎦ **1 Day**
2010-12-13
2010-12-08 ⎤
2010-12-07 ⎦ **1 Day**
2010-11-02 ⎤
2010-11-01 ⎦ **1 Day**
2010-10-11
2010-09-01
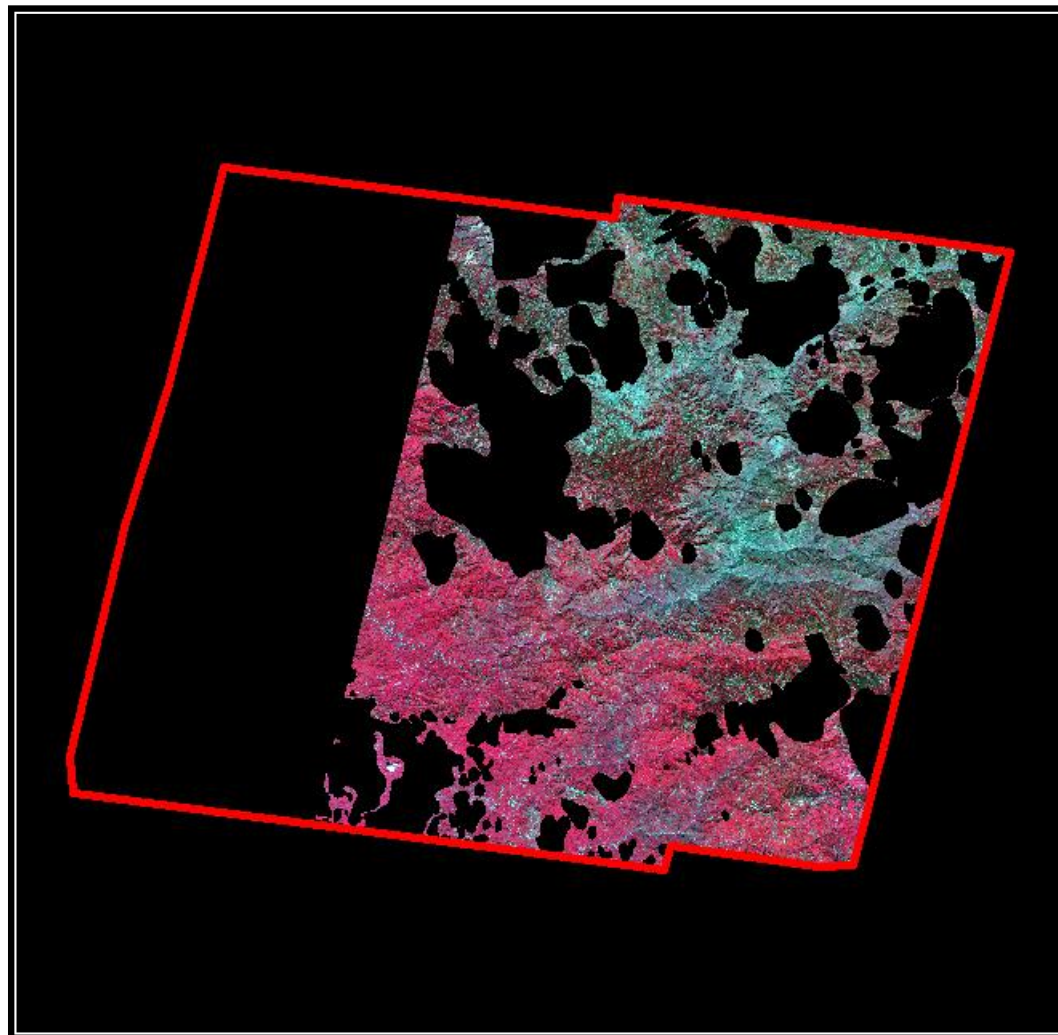
RapidEye Temporal Coverage

Change

2011-09-22-&-24
2011-09-07
2011-08-20
2011-07-25
2011-06-26-&-29
2011-05-01-&-02
2011-04-16-&-17
2011-02-13-&-16
2011-01-23
2011-01-17-&-18
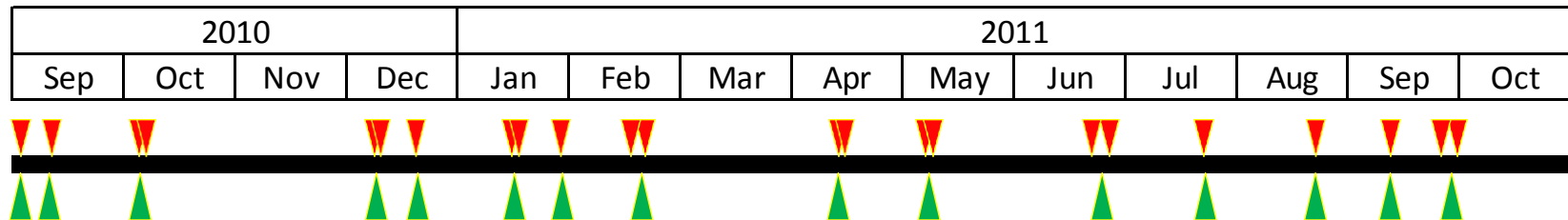**2010-12-13**
2010-12-07-&-08
2010-11-01-&-02
2010-10-11
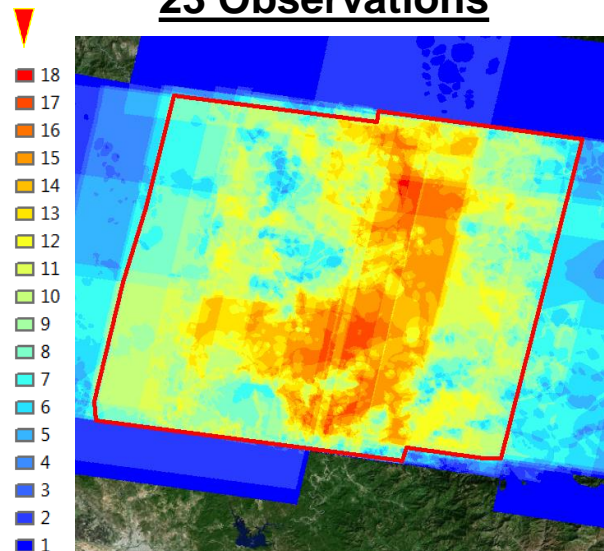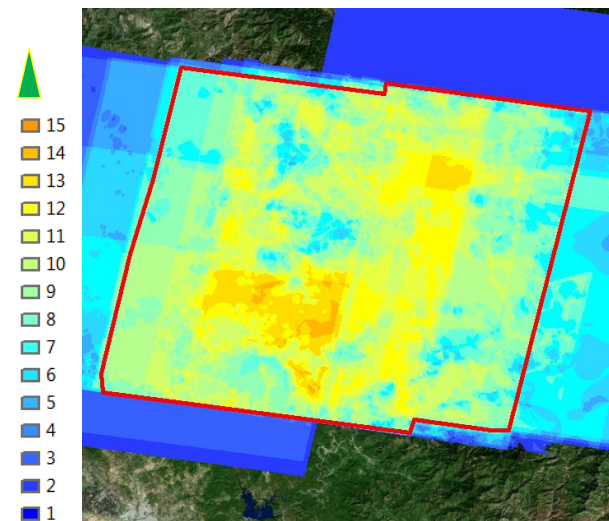**2010-09-01**
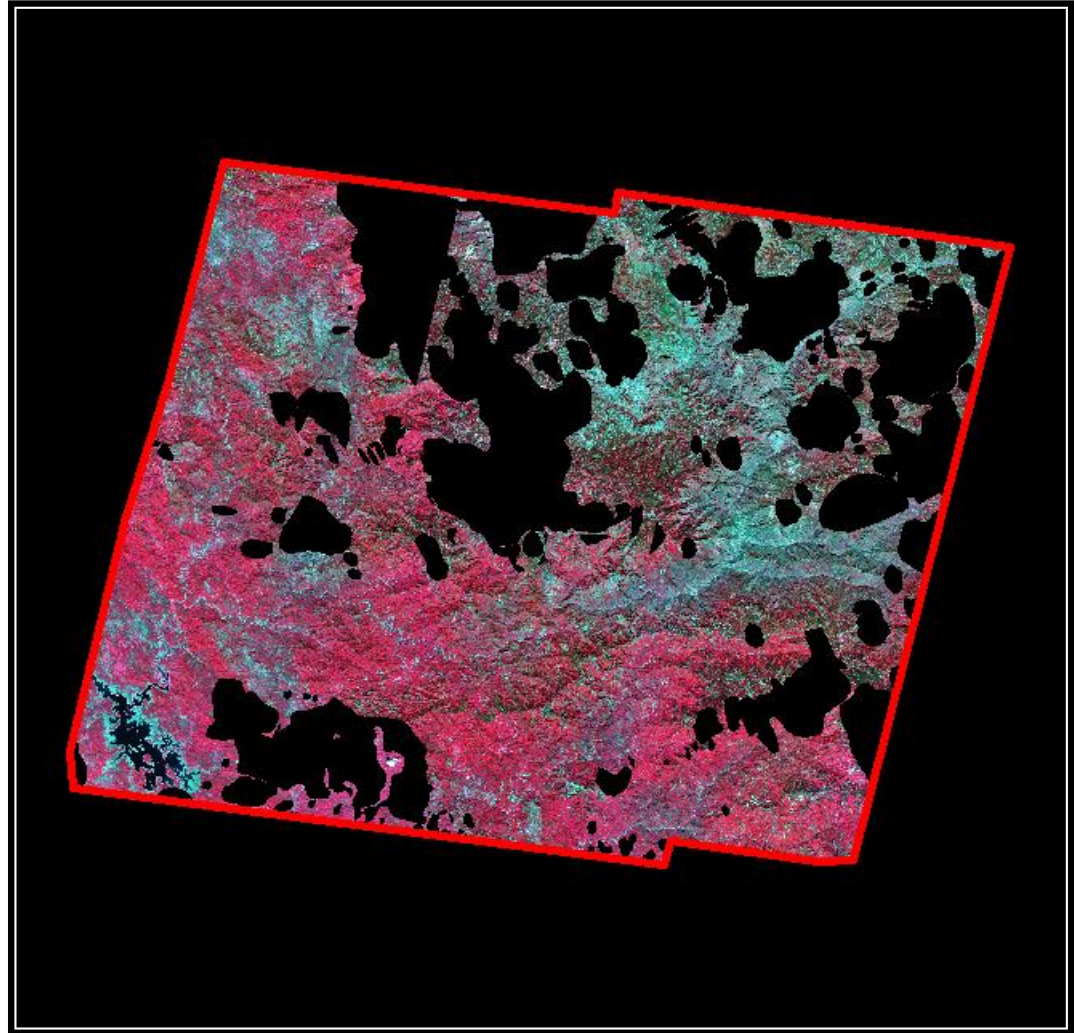
Less Is More

23 Observations

15 Observations

Outline

- Introduction to MDA's Change Detection (CLC) Technologies

- Landsat as Source to CLC

- RapidEye as Source to CLC

- LS/RE: Strengths and Weaknesses

LS/RE: Strengths and Weaknesses

- Categories
  - Pixel resolution
  - Revisit schedule
  - Archive depth
  - Cost
  - Coregistration accuracy
  - Coverage uniformity

LS/RE: Strengths and Weaknesses

- Pixel Resolution
  - LS/RE: 30m vs. 5(6.5)m MSI

- Revisit Schedule
  - LS/RE: 16 days vs. <6 days (off-nadir)

- Archive Depth
  - LS/RE: 30 years (@ 30m) vs. 3 years

- Cost
  - LS/RE: Free vs. Commercially priced

- Coregistration
  - Landsat
    - Nadir collects
    - Uniform orthorectification control
    - Subpixel date-to-date coregistration
  - RapidEye
    - Frequent off-nadir collects
    - Microrelief creates false change
    - Available DEM accuracy often unsuitable for off-nadir collects

LS/RE: Strengths and Weaknesses

- Coverage Consistency
  - Landsat
    - WRS controlled
    - Nadir only collection
    - Uniform Coverage
  - RapidEye
    - Frequent off-nadir collects
    - AOIs requiring multiple collects forces off-nadir acquisitions
    - Consistent AOI coverage is challenging

⌬MDA

INFORMATION SYSTEMS INC.
a U.S. company

Thank you

Jon Dykstra
Jon.Dykstra@MDAUS.com
(240) 822-8252